NOTES BY THE EDITOR.

WIND FORCE IN TORNADOES.

A correspondent asks: "Has any competent observer ever been able to make any estimate which you think would be at all near the truth of what the speed of the wind is in the funnel of a violent tornado?"

The following reply by the Chief of Bureau will be of general interest:

Prof. F. H. Bigelow has published on page 633 International Cloud Report, Vol. II, Report Chief of Bureau 1898–99, the results of his computation on the great waterspout seen off Cottage City, Mass., August 19, 1896. He gives the following additional facts: This large tornado tube or water spout over the ocean was seen from several localities, and the direction noted so that it was easy to place its position on the map with much exactness. At the same time a series of large pictures were photographed by Mr. Chamberlain, of Cottage City, showing the spout in several positions relative to the landscape in the foreground. Professor Bigelow visited the place and made a suitable survey of the distances so that the scale of the photograph was found, and from this the dimensions of the tube and the height of the cloud. By means of the proper formula the following dimensions in feet, and velocity in miles per hour for the different components were obtained:

Height above sea level.	Diameter of tube.	Radial velocity outward.	Rotational velocity.	Vertical velocity upward.
Feet.	*Feet.*	*Miles.*	*Miles.*	*Miles.*
4,200	.....	.....	.....	.....
4,198	3,402	7.0	14.1	0.04
3,901	506	1.0	94.4	2.50
3,599	400	0.6	119.5	3.90
3,301	290	0.6	164.0	7.40
2,999	250	0.5	189.0	9.90
2,398	204	0.4	233.0	14.90
1,802	178	0.4	268.0	19.80
1,499	168	0.3	284.0	22.20
1,201	158	0.3	300.0	24.70
601	144	0.3	328.0	29.60
479	144	0.3	333.0	29.70
0	134	0.3	354.0	34.60

A more thorough study of the data shows that the lower portion of the vortex tube is enlarged over these diameters on account of the friction due to disturbing the water, to the raising of the spray to a height of 500 feet when it is cast out of the tube, and to the indraught of air required to supply the vortex. The effect of this is to increase the size of the tube at the ocean to about 200 feet, and to reduce the rotating velocity to about 300 miles per hour, and the vertical internal draught to about 30 miles per hour. These dimensions and velocities characterize the largest tornado tubes, and together with the fall of internal pressure by the amount of 3 or 4 inches, they readily cause the destructive effects noted so conspicuously at Louisville, Ky., and St. Louis, Mo., in recent years.—*H. H. K.*

A NEW FIELD FOR KITES IN METEOROLOGY.

The following article, by A. Lawrence Rotch, is reprinted from Science, N. S., Vol. XIV, No. 350, pp. 412–413, September 13, 1901:

Although kites carrying recording instruments to a height exceeding three miles have rendered great services to meteorology at Blue Hill and elsewhere, they have been subject to the limitation of requiring a wind that blows at least 12 miles an hour. In certain types of weather, notably anticyclones, the winds are light and consequently observations with kites can rarely be obtained at these times. It also happens frequently that while the wind at the ground is sufficient to raise the kites it fails completely above the cumulus clouds so that the kites are unable to penetrate this calm zone.

By installing the kites and apparatus on a steamship, not only can kites be flown in calm weather, but observations may be made above the oceans where little is known about the conditions of the upper air. It is evident that a vessel steaming 12 knots an hour through a calm atmosphere will raise the kites to the height they would attain in a favorable natural wind, while the force of strong winds can be moderated by steaming with the wind. In this way kites can be flown on board a steamer under almost all conditions and probably more easily than on land, since the steadier winds at sea facilitate launching them. Wherever these observations in the upper air may be made, there is always a station at sea level and not far distant horizontally with which to compare them.

To test the practicability of this method of flying kites, experiments were undertaken on August 22, 1901, with the aid of my assistants, Messrs. Fergusson and Sweetland, upon a towboat chartered for this purpose to cruise in Massachusetts Bay. Anticyclonic weather conditions prevailed and a southeast wind blew from 6 to 10 miles an hour, but at no time with sufficient velocity to elevate the kites, either from sea level or from the summit of Blue Hill. With the boat moving 10 miles an hour toward the wind, and within an angle of 45° on either side of its mean direction, the resultant wind easily lifted the kites and meteorograph with 3,600 feet of wire to the height of half a mile.

While it is desirable to have a vessel that can be started, stopped, and turned at the will of the meteorologist, as was the case in the experiments described, it is nevertheless probable that soundings of the atmosphere can often be made from a steamship pursuing its regular course, and such are about to be attempted by me on a steamer eastward bound across the North Atlantic. Although observations above all the oceans are valuable, the exploration of the equatorial region is the most important, since, with the exception of a few observations on the Andes and on mountains in Central Africa, we know nothing of the conditions existing a mile or two above the equator. The need of such data to complete our theories of the thermo-dynamics and circulation of the atmosphere was urged by the Russian meteorologist, Woeikof, at the Meteorological Congress in Paris last year. North and south of the equator, within the trade wind belts, kites might be employed to determine the height to which the trades extend, and also the direction and strength of the upper winds, concerning which the high clouds, rarely seen in those latitudes, furnish our only information. In order to deduce the velocity recorded at the kite, it is necessary to ascertain the direction of this latter force, which could be done from the orientation of the kite.—*H. H. K.*

WEATHER BUREAU BULLETINS WANTED.

A correspondent desires copies of Bulletins No. 15, 20, 21, 24, and 27 to complete his set. Any person having one or more of these bulletins which he does not care to keep will confer a favor by notifying the Editor.—*H. H. K.*

CLIMATE AND CROPS: A PROBLEM WITH TWO SOLUTIONS.

The following letter was recently received by the Chief of Bureau from Mr. C. M. Donner, Secretary and Treasurer of the Hall's Island Farms, near Seabrook, Beaufort County, S. C.; it submits an interesting problem for consideration:

We have been for the last fifteen years interested in truck farming in this locality, and asparagus culture has been one of our specialties. You are probably aware that asparagus beds are to all intents and purposes permanent, the bushes dying off in the fall and the crop consisting of the new shoots which sprout up from the roots as soon as the temperature of the ground and the air is sufficiently high; our market is in the North, where good prices are paid as long as there is no supply from New Jersey, Long Island, etc. As soon as the more northerly produce appears in the market, prices drop to a level which leaves no profit to the southern grower, owing to the high freight he has to pay, there being no outlet for his produce near by.

You will at once perceive that an early commencement of spring is very necessary to the success of this business, that is to say, early, as compared with the season in the Northern States, as the crop is not harvested at once but brought into market daily, and the harvesting can be continued under favorable circumstances for more than two months; sometimes even three months.

We have a great interest in any apparent change in the climate, and also a good opportunity of observing such changes, as the asparagus plant is a pretty good indicator of the temperature of the air and ground.

Now we have observed that during more than ten years there has evidently, with minor fluctuations, been a steady retardation of what may be called "growing weather," so that whilst in 1890 we cut our first asparagus on January 9, and went on harvesting until after April 30, we only commenced cutting this year on March 21, and shall be very glad if we get more than six weeks altogether in which to ship our crop.

The Weather Bureau having all the necessary data can, of course, decide whether our impressions as to a gradual shifting of the seasons

in the South without a corresponding change in the North are based upon facts, and if so, it no doubt has formed theories regarding the same.

What mainly interests us is to know whether any conclusion has been reached as to the probable course the climate will take in the near future, that is to say, if it is at all likely that we have to deal with a fluctuation in the climate of which this is only the beginning, and which may extend over a considerable period, or if the climate may at any time return to its normal state.

In this connection it also occurs to us that we are in reality quite ignorant as to what may be considered the normal climate of South Carolina, and that there is a possibility that we are now returning to it, the preceding ten or twenty seasons being in reality abnormal ones.

If you will kindly give us the fullest information possible on this subject, which is of vital interest to us, and refer us to whatever literature may have a bearing upon it, we shall esteem it a great favor.

To the above letter the Chief of Bureau sent the following reply treating of the climatic question alone:

The subject concerning which you write is of transcendent importance; one that has been fruitful of much discussion during late years. It was brought to the front by the orange growers of Florida who, after having suffered from repeated disastrous freezes, naturally conceived the idea that the climate must have permanently changed. The pioneers of the middle west some years ago, in the belief that the rainfall to the westward was increasing, pushed out over the plains far beyond the borders of the humid region. After a year or so of abnormally heavy rainfall the natural conditions prevailed; conditions, it is needless to say, inimical to success in agricultural pursuits. Hundreds of persons were forced to abandon their claims and return to more humid regions.

Thus it is there arise from time to time, not only in this country but throughout the civilized world, apparently well grounded beliefs that the climate, either in respect to temperature or rainfall, has changed materially, or is slowly changing. That there have been marked changes in climate during the ages that have passed is clearly evidenced by the results of biologic and geologic surveys, not to speak of the results of equally important investigations that have been prosecuted in other branches of physical science. Such changes, however, occurred for the most part during the formative period of the earth's history and generally before it was inhabited by man. The occurrence of the Great Ice Age, the last important climate change, has been referred to purely astronomical causes, such as the secular or long periodic changes of the eccentricity of the earth's orbit and of the obliquity of the ecliptic, but there is not unanimity of opinion as to its probable cause.

The evidence of material change in climate during historic times is fragmentary and inconclusive. Strange as it may seem, instrumental data are not available in any part of the civilized world for a period longer than three hundred years, and even these are subject to an uncertainty of several degrees in the case of temperature, owing to the imperfections of the earlier instruments and methods. Then, too, the probable effect of man's occupancy of the earth is practically an unknown factor. Through his agency large portions of the earth's surface have been deforested and placed under cultivation. Water has been diverted from the streams and spread over the soil, thus transforming deserts into fertile plains. The latter in turn, through the varying fortunes of dynasties and empires, have again become arid and, with the onward march of progress, other portions of the desert regions of the globe have been brought under cultivation. While the total effect of such changes in the earth's surface as man has wrought is probably small, who can say that it has been absolutely nil?

It is the general belief in scientific circles that the radiating energy of the sun, upon which climate for the most part depends, has not altered within historic times, yet we can not argue constancy of climate from this fact alone, since the atmosphere becomes heated, not from the direct rays of the sun alone, but in great part from the ground by means of radiation, contact, convection, etc. The absorbing power of air for heat radiations is variable, depending somewhat upon the quality of aqueous vapor, carbonic acid, and dust that it contains. These, especially the latter, may have changed materially since the earth was inhabited by man. If we grant that the absorbing power of the atmosphere is subject to small variations from year to year we would still have an effect that would hardly be appreciable to the senses.

Passing now to the consideration of the facts named in your letter, I would say that the records of the Weather Bureau show that during the last fifty years there have been three marked cold periods in the South Atlantic States, viz, from 1852 to 1857, both inclusive; from 1871 to 1875, both inclusive; and from 1892 to 1901, both inclusive, a total of twenty-one years out of fifty. All of the years within the above-named periods were not uniformly cold; indeed, in the last-named period there were at least two normal winters, viz, those of 1894 and 1898. On the other hand, there occurred throughout the remaining periods of years cases of single cold winters, as that of 1878–79, and of two consecutive cold winters, as those of 1885–86 and 1886–87.

The damaging cold in the recent term of cold winters appears to have occurred, with but few exceptions, in February, and that fact may have impressed you more than would a continued cold in December or January. You have also unconsciously fallen into error in referring to the winter of 1889–90 as a standard of comparison. That winter was extraordinarily warm for the latitude of Charleston. In fact, the temperatures you experienced that season were appropriate to central Florida. There has not been another such winter as that of 1889–90 east of the Rocky Mountains since Weather Bureau observations began. You may remember that both November and December of 1889 were warm, pleasant months, and that there was practically no severe weather at Charleston during the entire winter. The warm weather was due to the fact that substantially all of the storms of the season passed across the country far to the north of Charleston, thus inducing warm southerly winds over the South Atlantic States. In cold years the interior of the country is covered by an area of high pressure, around the southern edge of which are found the conditions of heat and moisture necessary to the development of storms. You may recall that in cold winters the storms that visit your section generally approach by way of the lower Mississippi Valley or the Gulf of Mexico, and that they are almost invariably followed by cold northwesterly winds and several days of low temperature.

Why the storms of one year move in much higher latitudes than those of another year is one of the unsolved problems of meteorology.

We may add that inasmuch as the temperature and moisture of the soil is the primary consideration in the production of early spring crops, therefore the gardener must keep a record of the temperature at 3, 6, 12, and 15 inches below the surface of the soil if he wishes to understand the variations of his crops with the seasons. Such thermometer records should give indications as to when mulching and shading are needed, and enable one to predict quite closely the progress of development of roots, tubers, and sprouts.—*C. A.*

SEISMOMETERS IN METEOROLOGY.

Mr. F. Napier Dennison, of the Canadian Meteorological Service, stationed at Victoria, Vancouver Island, read a paper at the British Association at Glasgow on the seismometer as a weather forecaster. His paper in Symon's Meteorological Magazine for 1901 defends the idea that the seismograph can be used as a sensitive barometer. The seismographic pendulum points from the low barometer toward the high pressure. The enormous pressure taken off of the earth's surface within areas of low pressure and added to the pressure or weight over high areas, seems to make the crust of the earth bend like an elastic shell. Mr. Arthur Harvey, of Toronto, suggests that if at any station there be two good-sized seismometers of the pendulum type, oscillating at right angles, with perhaps a third between them, and if for convenience of observation the pens at the points of the swinging bars come close to each other, one would probably be able on the Pacific coast to tell the direction of an approaching low area.—*C. A.*

THE OBSERVATION OF SHOOTING STARS.

It is a very common matter for both regular and voluntary observers and occasional correspondents to mention the occurrence of a shooting star or bright meteor. Such events occur every day in many parts of the globe. Millions of meteors daily strike the earth's atmosphere and are burnt up, thereby adding a little to the mass of the earth and to the heat within the atmosphere; but the sum total of these effects is apparently inappreciable in meteorology. The real interest that attaches to the bright meteors is the effort to classify them according to the directions whence they come in space and the altitude and velocity with which they move. It is hardly worth while to mention the occurrence of a meteor unless the observer will add some approximate statement giving, as precisely as he is able to do it, the angular azimuth and altitude of that point in the sky where he first saw it and